distributed over the exterior of the vessels of the gills (Pl. XVIII. fig. 6).

The part enacted by the adipose element in the physiological act of respiration, replete with novel interest, belongs to the physiological bearing of the question of respiration*.

In the preceding review of the mechanical condition of the respiratory process as it occurs in the higher Articulata, the physiologist must have observed the comparative fewness of the corpuscles of the blood (Pl. XVIII. fig. 11), the smallness of the bulk of the blood relatively to the dynamical capabilities of the articulated animal, the small proportion of blood which in a given time traverses the branchial organs, the *breadth* of the ultimate blood-stream measured by the size of the pulmonary capillary of the vertebrated animal. These facts seem certainly to prove that there can exist no direct proportionality between the amount of respiratory process and the general dynamical capabilities of the Crustacea†.

EXPLANATION OF PLATES XVII. AND XVIII.

PLATE XVII.

Fig. 1. Appendages of the ninth pair composing the external foot-jaws of Decapod Crustaceans, and which are homologous with the subcylindriform process of the first pair in *Squilla*, with the thoracic feet of the twelfth in Isopodan Crustacea, and with the thoracic feet of the third pair in the Branchiopoda: *a*, internal element; *b*, palp; *d*, branchia; *c*, flabellum.

Fig. 2. Appendages of the eighth pair constituting the foot-jaws in the Decapoda,—which are homologous with the prehensile jaws in *Squilla*, with the thoracic feet of the first pair in the Isopods, and with the branchial processes of the second pair in the Branchiopods.

Fig. 3. Abdominal appendage of *Squilla*: *a*, internal member; *d*, external; *b*, branchia.

Fig. 4. Abdominal appendage of the *Isopoda*: *a*, external or cutaneous process: *b*, internal and branchial.

Fig. 5. Abdominal appendage of a Branchiopod. The dotted process is the respiratory.

Fig. 6, A. *Caprella linearis* (*male*): *a*, respiratory appendages; *b*, the same still further magnified; *b'*, shows the *single* blood-current moving

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* See *ante*, "Process of Respiration."

† I have understood that some years ago a paper was read by Prof. Quekett, before the Microscopic Society of London, "On the structure of the *flabella* in the Crustacea." It has never been my good fortune to see that paper. The description given in the text is founded upon a very extensive series of original examinations. I am desirous here to pay the tribute of my gratitude and admiration to Prof. Milne-Edwards, for the assistance and instruction which I have received from the study of his numerous splendid contributions to this branch of comparative anatomy.

round the circumference of the process; C, corpuscles of the blood.

Fig. 7, B. A single pair (magnified and viewed by transmitted light) of the branchial leaflets of the Hermit Crab: *c, d,* two longitudinal blood-channels, seen in section; *f, g.* embrace a deep groove between the leaflets for the branchial current of water; *i, h.* denote the parenchymatous islets situated between and dividing the blood-streams (*o*); M, a single seta, *mop-like,* from the roof of thoracic cavity; *k,* sharp teeth on its shaft; *h,* another variety of seta.

Fig. 8, A. A single gill of the Lobster, represented as a transparent object in transverse section: *a,* section of afferent vessel. The arrows exhibit the division and direction of the afferent blood in its course towards the ultimate branchial tubules (a'''). The ultimate afferent current occupies the *axis* of each tubule; a'', marks (in section) the great afferent trunk of the gill, receiving its blood as shown by the arrows from the *circumferences* of the tubules. B, a single tubule enlarged; *b,* afferent vessel, having cribriform walls; *c, c,* the efferent stream; at (*c*) the capillary system of the tubule is seen. C, the same tubule seen in section. D, one of the interbranchial flabella. E, a single mop-like seta from its edge; *f,* one from its flat surface.

Fig. 9, A. A single pair of the branchial laminæ of the Crab: *a & b,* afferent and efferent trunk, connected together by means of the intermediate branchial laminæ. These latter are composed of parallel epithelial plates tied together by means of minute intermediate nodules of fleshy substance. Between these the blood streams in *im*parietal passages. B, horizontal flabellum of the Crab; C, D, E, setæ with which it is armed.

Plate XVIII.

Fig. 1. Leg, and the projecting free border of the epidermal plates of *Talitrus.* Intended to express typically the *ultimate* respiratory structures of all Crustaceans: *a,* a nodule of fixed parenchyma, composed of *slightly refracting* oil-cells, nucleated granular cells, and molecules;—generally such a group is destitute altogether of embracing membrane; *b,* the irregular imparietal, angular passages lying between the parenchymatous nodules; *c,* the cells of the epidermis, *attenuated.*

Figs. 2, 3 & 4. Varieties of epithelial cells met with in different parts of the Crustacean: *a,* a cell shown in full, under a high power, to bring out its granular character; *b,* the same in outline.

Fig. 5. The parenchymatous patch *a,* fig. 1. enlarged, to show its minute structure: *a, b,* epithelial laminæ; *c.* represents exactly the peculiar, low refractive character under which oily-element exists in the fixed solids of the Crustacea. The whole *interior* of this patch is permeated by lateral slow-moving currents of blood, diverted from the main stream.

Fig. 6. A small piece of the wall of the large branchial vessels, showing the hooks (*a*) on which act the setæ of the flabella.

Fig. 7. A portion of the proximal end of a *hair,* to exhibit the absence of vessels and to show the lacunose to-and-fro character of the blood-movement.

Fig. 8. The active, vibratory, abdominal palp of the Shrimp.

Fig. 9. The same viewed transparently: *b, c,* epithelial laminæ; *e,* radia-

ting muscular fascicles; *d*, radiating imparietal blood-channels; *d*, setæ.

Fig. 10. Liver-follicle of the Lobster, viewed by transmitted light: *a*, *b*, cæcal end, having glandulose walls by the swelling of the parietal epithelial cells; *c*, the secreted product in its first stage, oil-cells colourless and minute; *d*, *d*, the same increasing in size and becoming yellow in colour; *g*, oil-cell; *h*, yellow cell.

Fig. 11 is *fig.* 12 enlarged. It shows the ultimate structure of the tentacle of a Prawn. The muscular masses occupy the axis, and the blood-corpuscles course along the sides.

Fig. 13. Illustrates the mode in which the ultimate nerve-tubules are distributed in the gill-laminæ of several Crustacea: *b*, *c*, nerve-tubules; *c*, patches of parenchyma.

[To be continued.]

XXIX.—*Contributions to the Palæontology of Gloucestershire:—A description, with Figures, of some new Species of Echinodermata from the Lias and Oolites.* By Thomas Wright, M.D. &c., Professor of the Natural Sciences in the Cheltenham Grammar School*.

[With three Plates.]

[Continued from p. 173.]

Genus Pedina, Agassiz.

As this genus was incorrectly defined in our memoir on the Cidaridæ, it having been there stated that the mammillary eminences were "crenulated like those of *Diadema*," we take this opportunity of correcting the error, and giving a definition more in accordance with our present knowledge.

Test thin, circular, more or less depressed; primary tubercles small and perforated; mammillary eminences with smooth ring-like summits without crenulations; pores in general disposed in triple oblique pairs; mouth small and slightly decagonal, margin not much notched; ovarial disc small and not prominent; ambulacral areas with one, two, or more rows of small tubercles; interambulacral areas sometimes with two rows only, sometimes with two rows and additional secondary rows of tubercles more or less complete.

This genus is extinct, and is found in the oolitic cretaceous rocks.

Pedina Bakeri, Wright. Pl. XI. fig. 4, *a–c*.

Test circular, depressed; ambulacral areas narrow, with one row of small tubercles disposed in a slightly zigzag line down the centre of the areas; interambulacral areas broad, with two rows of primary tubercles raised on prominent mammillary emi-